
Microwaves To Measure Fruit Maturity

One Sunday in November 1991, Pinnick—then working at the nearby White Sands Missile Range—accompanied Anderson for an afternoon on the Jornada. Anderson showed him his traditional technique for collecting and analyzing fecal pellets. The next month, they began firing lasers at sheep pellets.

Since then, Anderson has analyzed more than 100 samples of rangeland plants and animal manure. He and his physics colleagues have found the light fingerprints of many plants including alfalfa, native tobosa grass hay, and a shrub called tarbush.

A colleague at Los Alamos National Laboratory is interested in the potential to monitor the diets of wild deer and elk that graze on federal land. Wild animal diet analysis is important to developing wildlife management strategies.

Anderson's basic technique is simple. He uses chloroform or a saline solution as a solvent to extract samples of plants and manure. Then, in a darkroom, the laser or xenon beam is aimed at the sample. Both the laser and the xenon lamp are connected to electronic equipment for capturing and analyzing light fingerprints.

"We would like to evaluate about 500 rangeland plant species found on the Jornada, starting with the 25 or 30 most popular with our livestock," he says. "We also need to evaluate results in different seasons and with other solvents."—By **Don Comis**, ARS.

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Microwave ovens deserve their reputation for making food preparation easier and faster. But in the future, microwave technology may play a taste-tester role that could mean fresh fruits and vegetables arrive at the table with even more fresh, just-picked flavor.

The microwaves used in this research were at a very low level. The goal wasn't to cook the fruits and vegetables but to measure the properties that influence how electromagnetic waves pass through them.

Two of these properties are well known to physicists and electrical engineers but may be new to others. The dielectric constant tells how a material, living or not, stores electric energy. The dielectric loss factor indicates the ability of a material to absorb energy from an electric field and convert it to heat. As it turns out, there is a correlation between these dielectric properties and the maturity of fresh produce.

"We characterized produce from a microwave viewpoint," says Agricultural Research Service's Stuart Nelson. "We did this to build a database and explore its use as a measure of maturity in peaches."

Nelson, an agricultural engineer, and Roy Forbus, an industrial engineer who is now retired, measured dielectric properties on 23 fruits and vegetables for their database. The scientists got their samples at the same place consumers usually find theirs: the supermarket produce section.

Once they had a database with information about the dielectric properties of fruits and vegetables in general, Nelson and Forbus were ready for a subsequent project. They would look at microwaves as a tool for evaluating ripeness in peaches. This time, the University of Georgia's Agricultural Experiment Station made peaches available to test—Forbus and a student did the picking.

Why look at microwaves as an evaluating tool? They may detect total soluble solids, which are really sugars, in fruits such as peaches. Sugars increase with ripeness. Not enough sugars means your peach was probably taken too soon from the tree.

Preliminary results suggest low-level microwave measurements may lead to development of instruments that growers could use to pinpoint ideal harvesting times. Dielectric properties varied with microwave frequency and the character of the produce itself, such as the fruit's chemical composition and the amount of water in it.

A bonus of this research is that the information could help processors of microwave foods keep the fruit compote in your TV dinner more flavorful during that fast-track heating.—By **Jill Lee**, ARS.

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